ANTUSD: A Large Chinese Sentiment Dictionary

Shih-Ming Wang and Lun-Wei Ku

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- Extended-HowNet (E-HowNet)

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Motivation

- Sentiment dictionary
  - A building block of sentiment analysis & opinion mining
  - Applied as markers or machine learning features
- Augmented NTU[1] Sentiment Dictionary (ANTUSD)
  - Lack of Chinese resource
  - Big & complete
  - Expert labeled sentiment & machine predicted sentiment scores

[1] The original authors of NTUSD were researchers at National Taiwan University

An Algorithm For Finding Primes Numbers.

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int main (void)
{
  std::vector<bool> is_prime (100, true);
  for (int i = 2; i < 100; i++)







  return 0;
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             is_prime [j] = false, j+=i);
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Note the use of std::.

Related Corpora I

- Words and labels were collected from several sentiment corpora (2006∼2010)
- Word-base, context free
  - NTUSD
    - Labels: **POS** and **NEG** (2812/8276)
    - A widely used Chinese sentiment dictionary
  - ACIBiMA[2]
    - Labels: **POS**, **NEU**, **NEG**, **NONOP**, and **NOT**
    - Built to test Chinese morphological structure and sentiment
    - **NONOP** consists of regular non-emotion words
    - **NOT** consists of incorrectly segmented words

[2] Advanced Chinese Bi-Character Word Morphological Analyzer

Related Corpora II

- Sentence-based, context dependent
  - NTCIR [3] MOAT Dataset & Chinese Opinion Treebank
    - Labels:**POS**, **NEU**, and **NEG**
    - Sentence sources: MOAT [4] tasks; Chinese Treebank
    - Labeled sentences and sentiment word
    - Label count $\propto$ word frequency
  - ANTUSD collects only count
    - Context information is missed
    - Each word might have conflicting labels

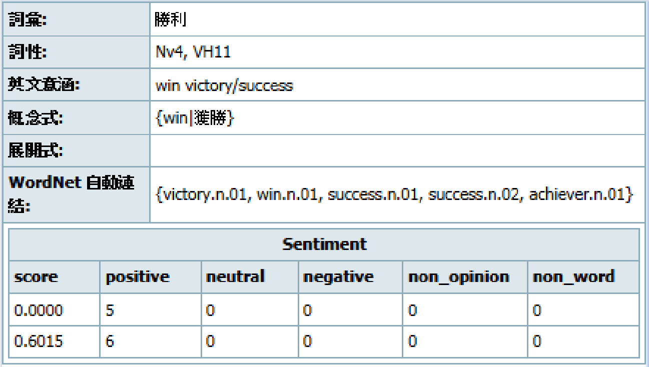
[3] http://research.nii.ac.jp/ntcir/index-en.html
[4] Multilingual Opinion Analysis Test Collection

CopeOpi

- A Chinese opinion-analysis system
- Polarity score of each character is calculated statistically
- Score of any document, sentence, or word is determined by its components
- ANTUSD also record CopeOpi score for each word

Extended-HowNet (E-HowNet)

- E-HowNet: a frame-based entity-relation model extended from HowNet
- Define lexical senses (concepts) in a hierarchical manner
- Now integrated with ANTUSD and covers 47.7% words in ANTUSD



詞彙:	勝利
詞性:	Nv4, VH11
英文直譯:	win victory/success
概念式:	{win|獲勝}
展開式:	
WordNet 自動連結:	{victory.n.01, win.n.01, success.n.01, success.n.02, achiever.n.01}

Sentiment					
score	positive	neutral	negative	non_opinion	non_word
0.0000	5	0	0	0	0
0.6015	6	0	0	0	0

Demonstrative Experiment

- Dataset: ANTUSD ∩ E-hownet, a total 12995 words
- Three sentiment analysis tasks
  - Opinion extraction: identify opinion words ({**POS**,**NEG**} v.s. **NONOP**)
  - Polarity classification: classify opinion words (**POS** v.s. **NEG**)
  - Combined tasks (**POS**, **NEG**, **NONOP**)
    - $P = \frac{correct(opinion) \cap correct(polarity)}{proposed(opinioopinionn)}$
    - $R = \frac{correct(opinion) \cap correct(polarity)}{gold(opinioopinionn)}$
    - $F - score = \frac{2PR}{P+R}$
- Classifier: support vector machine (SVM) with linear kernel

Preprocessing

- Extract single label for each word
  1. **NOT**: Count(Not)$>$0
  2. **NONOP**: Count(Non)$>$0
  3. **POS**: Count(Pos)$>$0 and Count(Neg)$=$0
  4. **NEG**: Count(Neg)$>$0 and Count(Pos)$=$0
  5. **NEU**: Count(Pos)$=$0, Count(Neg)$=$0 and Count(Neu)$>$0
- Neutral words are dropped since there are only 16 of them
- Words not labeled are also dropped (e.g., Count(Pos)$>$0 and Count(Neg)$>$0)

Features

- CopeOpi score in ANTUSD
- Synonym-Set index (SSI)
  - Concept frame index of a word
  - Each word might belong to many concepts
  - Represented as a binary vector
- Trained word embedding with the corpus LDC2009T14 (Chinese news)
  - Word vectors
  - Summation of char vectors

Opinion Extraction

- COP, SSI has lower precision
    - opinion extraction is more semantic-oriented
    - Many words contain single SSI
- Character vectors lead to less precise semantic representation
- Features are complemented; combined features leads to improvement

Feature(s)	Precision	Recall	f-score
COP	0.686	1.000	0.814
SSI	0.693	0.993	0.816
WV	0.784	0.936	0.854
CV	0.765	0.919	0.835
COP+SSI	0.740	0.914	0.818
COP+WV	0.785	0.933	0.853
COP+CV	0.764	0.917	0.833
SSI+WV	0.789	0.937	0.856
SSI+CV	0.772	0.920	0.840
WV+CV	0.808	0.921	0.861

Polarity Classification

- COP leads to a significant better result, reflecting is sentiment-oriented nature
- Combining COP & other features still leads to improvement
- Combining word vectors and SSI also leads to improvement

Feature(s)	POS f1	NEG f1	Average f1
COP	0.973	0.976	0.974
SSI	0.792	0.842	0.817
WV	0.870	0.895	0.882
CV	0.829	0.851	0.840
COP+SSI	0.979	0.982	0.980
COP+WV	0.981	0.984	0.982
COP+CV	0.967	0.972	0.970
SSI+WV	0.898	0.915	0.907
SSI+CV	0.868	0.886	0.877
WV+CV	0.899	0.916	0.908

Combined Task

- COP outperforms the others
- Both the numerator of precision and recall are affected by COP's better polarity classification ability
- Only the denominator is affected by COP's worse opinion extraction ability
- WV+CV outperforms WV due to coverage issue

Feature(s)	Precision	Recall	f-score
COP	0.912	0.927	0.920
SSI	0.706	0.679	0.692
WV	0.737	0.767	0.752
CV	0.689	0.721	0.705
COP+SSI	0.864	0.945	0.903
COP+WV	0.850	0.902	0.875
COP+CV	0.840	0.869	0.854
SSI+WV	0.764	0.796	0.779
SSI+CV	0.732	0.755	0.743
WV+CV	0.764	0.813	0.787

Conclusion

- A so far the largest Chinese sentiment dictionary
- Manually sentiment labels & machine estimated sentiment scores
- Three experiments were conducted to demonstrate the usage of ANTUSD

Q & A